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SIGNIFICANT FEATURES OF WIRE-SAW OPERATION IN EUROPE

BY

OLIVER BOWLES

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WIRE SAWS IN EUROPE AND AMERICA

Wire saws have been used for many years in European travertine, marble, and slate quarries. This method of sawing found very limited use in America until 1927 when it was accepted as standard equipment in slate quarries in Pennsylvania where it has been remarkably successful. Details of its operation in slate have been published in a recent bureau report.[3]

The very limited extent to which the wire saw has been employed in limestone and marble quarries in the United States and the seeming lack of interest even in experimental work to determine its advantages are difficult to explain in view of its wide use in cutting similar rocks in Europe and its unquestionable advantages in sawing slate in America. In order to encourage improvement in quarry practice the United States Bureau of Mines has endeavored to obtain information as to the extent to which wire saws are used in Europe together with data on the rate and cost of sawing. The information at hand is by no means complete either in territory covered or in details of operation; it nevertheless brings out certain significant features that may be of interest and advantage to quarrymen in the United States.

1 - The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6483."
2 - Supervising engineer, building materials section, U. S. Bureau of Mines.
3 - Bowles, Oliver, The Wire Saw in Slate Quarrying: Tech. Paper 469, Bureau of Mines, 1930, 31 pp.

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ACKNOWLEDGMENT

The data regarding foreign practice were furnished principally by foreign service representatives of the Department of Commerce in response to a Bureau of Mines questionnaire transmitted through the courtesy of W. H. Rastall, chief of the industrial machinery division of the Bureau of Foreign and Domestic Commerce.

WIRE SAWING IN ITALY[4]

About 150 wire saws are in use in the famous Carrara marble quarries and about 20 in the travertine quarries at Tivoli near Rome. Travertine is a variety of limestone somewhat softer than marble. In the travertine quarries the rate of cutting as reported is about 5.4 square feet (0.5 square meter) per hour, and the cost is about 20 cents per square foot (40 lire per square meter). Carrara marble can not be sawed as rapidly as travertine, and the cost is probably higher. The wires used are three-strand steel cables which vary in diameter from 0.16 to 0.22 inches (4 to 5.5 millimeters). Two types of wire are employed. For sawing in a quarry where accuracy is not demanded the wire is of the simple helicoidal type, that is, one in which the strands are twisted continuously in one direction. For sawing detached blocks of stone where accuracy in dimensions is required double-helicoidal wire is found to give best service. This type is made by twisting the strands in one direction for a certain length of the wire, and then reversing the twist, thus giving sections which are twisted alternately to right and left.

Sand is used as abrasive in sawing both marble and travertine.

WIRE SAWING IN FRANCE[5]

About 17 quarries are in operation in the marble district of southern France which skirts the Pyrenees Mountains. Wire saws are used extensively both in quarries and mills, but the number has not been ascertained. One of the larger companies reports that the wire used by them for sawing amounts annually to several car loads of 10 tons each. The length of wire used for sawing in mills varies from 164 to 1,969 feet (50 to 600 meters); and in the quarries from 2,625 feet (800 meters) to several thousand feet. No data have been obtained on the rate of sawing.

In the Nord district of northeastern France about 130 wire saws are in operation, chiefly among five companies. They are used only in the quarries, gang saws being employed for cutting blocks in the mills. The wire is 0.16 inch (4 millimeters) in diameter. Sand is used as abrasive.

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4 - Data supplied by Mowatt M. Mitchell, U. S. Commercial Attache, Rome, Italy.

5 - Data supplied by Thomas Butts, U. S. Trade Commissioner, Paris, France, with the assistance of American Consul Lucian Memminger at Bordeaux and American Consul Harold Playter at Lille.

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WIRE SAWING IN BELGIUM[6]

About 80 per cent of the 42 marble and other calcareous-rock quarries of Belgium employ wire saws, but the number has not been obtained. They are used both for sawing in quarries and for cutting detached blocks. The rate of sawing in quarries varies from 4.3 to 5.4 square feet (0.4 to 0.5 square meter) per hour. The cost of wire sawing in quarries is about 51 cents per square foot (140 francs per square meter), while the cost of sawing detached blocks is about 29 cents per square foot (80 francs per square meter). Information available is not sufficiently complete to indicate whether the costs given for sawing either in Belgium or in Italy are direct costs, or whether they include all overhead and indirect charges. Sand is used as abrasive.

No data have been obtained on the rate or cost of sawing slate in Europe.

COMPARISON WITH AMERICAN PRACTICE

It is interesting to compare the rates of sawing travertine and marble in Europe with the rate of cutting slate in Pennsylvania. That of Italian travertine as given above is 5.4 square feet per hour, and of Belgian marble 4.3 to 5.4 square feet per hour. In soft-vein slate in Pennsylvania as recorded in the report of this bureau previously cited the rate is 20 to 25 square feet per hour actual cutting time, or 14 to 17 square feet per hour allowing for all stops and delays. In hard-vein slate the rate is 10 to 12 square feet per hour.

The cost of sawing in European quarries which varies from 20 cents per square foot in travertine to 51 cents per square foot in marble is contrasted with a total cost in Pennsylvania slate of 19 to 25 cents per square foot.

From the above data it would appear that marble and travertine are sawed much more slowly than slate. Several operators who have tried wire saws in marble quarries in the United States have become discouraged at the slow rate attained and have abandoned the method. Evidently, however, long years of experience in Europe have proved that wire sawing is profitable even though the rate attained is only 4 or 5 square feet per hour. Figures presented herein should therefore encourage American quarry operators to devote further efforts toward perfecting the process.

Even though preliminary tests show rates of only 1 or 2 square feet per hour, attempts should not be abandoned without exhaustive experimental work, because increasing efficiency is usually attained by experience. It is noteworthy that in the first attempts to saw slate with a wire the rate attained was 9.7 square feet per hour; early the next year the average was 12.8, and in less than two years an average of 20 to 25 square feet per hour was attained. In other words, the earliest experimental rate of cutting was increased nearly threefold when methods and equipment were standardized.

Unquestionably much profitable experimental work could be done with a wire saw both in quarrying and in milling various types of structureal and ornamental stone.

6 - Data supplied by Leigh W. Hunt, Acting U. S. Commercial Attache, Brussels, Belgium.

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